Ventilator-Associated Pneumonia (VAP)

Victoria J. Fraser, MD,
Adolphus Busch Professor of Medicine and Chairman
Washington University School of Medicine

Washington University in St. Louis
School of Medicine

Barnes-Jewish Hospital

Disclosures & Acknowledgements

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Objectives

- Review the epidemiology of VAP
- Describe key issues related to diagnosing VAP
- Identify risk factors for & interventions to prevent VAP
- Discuss appropriate duration of therapy for VAP

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Epidemiology

- VAP: pneumonia occurring 48-72 hrs after intubation and start of mechanical ventilation
- 2nd most common ICU infection
- 80% of all nosocomial pneumonia
- Responsible for ½ of all ICU antibiotics
- Increased risk with duration of mechanical ventilation (MV)
  - Rises 1-3% per day
  - Concentrated over 1st 5-10 days of MV

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Epidemiology of VAP

- Approximately 300,000 cases annually & 5–10 cases per 1,000 admissions
- Prevalence 5 – 67%
- # 1 cause of death among nosocomial infections
- Increases hospitalization costs by up to $50,000 per patient

McEachern R, Campbell GD. Infect Dis Clin North Am. 1998;12:761-779; George DL. Clin Chest Med. 1995;1:29-44; Ollendorf D, et al. 41st annual ICAAC. September 22-25, 2001. Abstract K-1126; Warren DK, et al. 39th IDSA. October 25-28, 2001. Abstract 829.

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Epidemiology

- Two forms: early vs. late onset
- Case control studies 30% - 50% attributable mortality but not all studies suggest independent cause
- Higher mortality with *Pseudomonas* & *Acinetobacter spp.*
- Estimated cost savings $13,340 per VAP episode prevented

CCM 2003; 31: 1312-1317, CCM 2003; 31: 1312-1317, Chest 2002; 122: 2115-2121, CCM 2004; 32: 126-130

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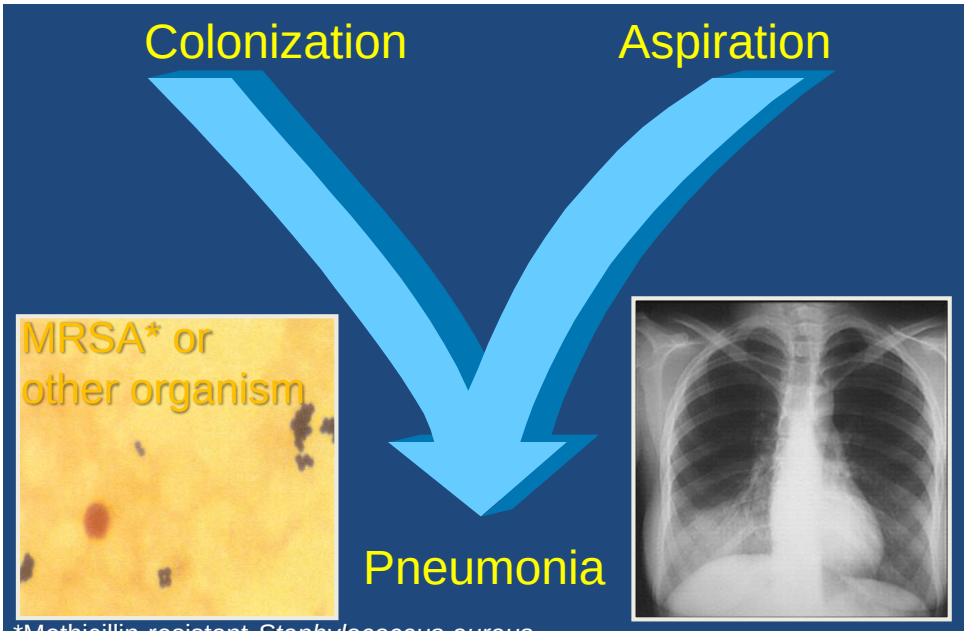

Potential Reservoirs: Nosocomial Pneumonia Pathogens

- Oropharynx
- Trachea
- Stomach
- Respiratory therapy equipment
- Paranasal sinuses
- Sanctuary (above cuff below cords)
- Endotracheal intubation decreases the cough reflex, impedes mucociliary clearance, injures the tracheal epithelial, provides a direct conduit for bacteria from URT to the LRT

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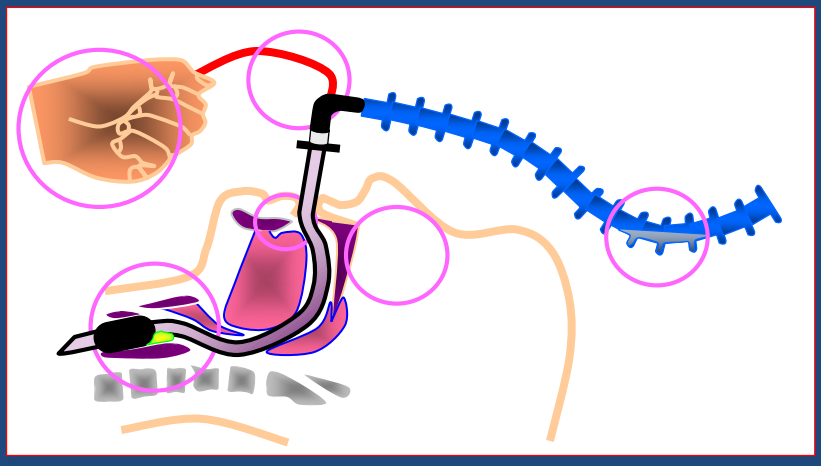
Pathogenesis



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VAP Microbiology

- Early onset (< 4 vent days); same as community acquired pneumonia (CAP)
- Late onset (≥ 4 vent days) antibiotic resistant organisms
- Colonization of oropharynx & stomach precedes VAP
- Pathogenesis = micro aspiration

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Pathogens

- *Pseudomonas aeruginosa* (17%), *S. aureus* (16%), *Enterobacter* (11%), *Klebsiella pneumonia* (7%), *E. coli* (6%)
- *S. aureus* & *P. aeruginosa* increasing, decreasing enterobacteriaceae
- Anaerobes with aspiration
- Special groups: Legionella, Aspergillus, CMV, Influenza

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VAP is Hard to Diagnose

- Approaches to diagnosis
  - Surveillance definition
    - CDC/NHSN definitions VAP:
    - Now→VAC→IVAC→Poss/Prob VAP→
  - Clinical definition for bedside use or studies
    - Clinical Pulmonary Infection Score (CPIS)
    - Clinician instinct ± invasive diagnostic approaches
- Surveillance definition and clinical definitions sometimes give different answers
  - It's important for the people doing surveillance & people receiving the reports to understand the difference

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Surveillance: Methodology

- CDC (NHSN) definition is most commonly used for surveillance
- Requirements
  - Active, patient-based, prospective
  - Performed by trained professionals in infection control and prevention (IPs)
    - Other personnel (or electronic systems) can be used for screening
    - Final determination via IP

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Old Surveillance: Case Finding

- Screening for cases often involved reviewing data from multiple sources
  - Microbiology reports
  - Pharmacy records
  - Admission / discharge / transfer data
  - Radiology / imaging
  - Patient charts (physician and nursing notes, vital signs, etc.)
  - Given the complexities of the diagnosis, retrospective surveillance may be difficult and inaccurate
  - Hence move to more objective criteria

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Past VAP Surveillance: Definition

- Combination of radiologic, clinical & laboratory criteria
- Ventilator-associated
  - If pt was intubated & ventilated at the time of or within 48 hrs before the onset of the pneumonia
  - No minimum time period

CDC/NHSN VAE, VAC, IVAC, Possible or Probable VAP

No more reliance on Radiography (due to subjective nature)
Stable Vent pt. ≥ 2days, FiO2 & PEEP :

For VAC
Minimum daily 1) ↑ FiO2 ≥ 20 x 2 days, or 2) ↑ PEEP ≥ 3 cm H2O x 2 days

For IVAC
At least 2 of the following clinical criteria:
•1) Fever (> 38^0C or > 100.4^0F) with no other recognized cause for fever or Leukopenia (<4000 WBC/mm3) or leukocytosis (≥12,000 WBC/mm3)
•2) New antimicrobials x 4 days

Possible VAP (1 needed)
•1) New onset of purulent sputum or change in character of sputum
•2) Positive culture
Probable VAP (1 needed)
- 1)Purulent secretion & positive culture
- 2)+ pleural fluid Cx, lung path, Legionella lab or Viral respiratory test

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Why Do Surveillance?

- CDC Guideline for Prevention of Nosocomial Pneumonia
  - to facilitate identification of trends & inter-hospital comparisons"
- Joint Commission Accreditation for hospital requires that an infection control risk assessment be performed annually
  - understanding of the areas in which patients are at risk for HAIs (including VAP)
  - Some outcome measures need to be made in order to assess this risk

CDC, MMWR 2004;53(No. RR-3)

A Different Definition: Clinical Pulmonary Infection Score

- CPIS is the most well-known clinical scoring system for VAP diagnosis
- Complete at bedside (day 3)
- CPIS > 6 had a sensitivity of 93% and a specificity of 96% vs. BAL quantitative cultures
- Subsequent studies did not find CPIS to be as accurate
- Better at predicting who does not have VAP

	0 points	1 points	2 points
Temperature (°C)	36.5 to 38.4	38.5 to 38.9	≤ 36.4 or ≥ 39
Peripheral WBC	4,000 – 11,000	< 4,000 or > 11,000 *> 50% bands: add 1 extra point*	
Tracheal secretions	None	Non-purulent	Purulent
Chest X-ray	No infiltrate	Diffuse or patchy infiltrates	Localized infiltrate
Progression of infiltrate from prior radiographs	None		Progression (ARDS, CHF thought unlikely)
Culture of ET suction	No growth/light growth	Heavy growth *Same bacteria on gram stain: add 1 extra point*	
Oxygenation (PaO_2/FiO_2)	> 240 or ARDS		≤ 240 and no ARDS

Pugin et al. Am Rev Respir Dis 1991 143:1121-9

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Clinical Diagnosis of VAP

- Presence or absence of fever, leukocytosis, or purulent secretions alone are not that helpful
- Combination of new radiographic evidence of infiltrate + at least 2 of these increases likelihood of VAP
- Absence of new infiltrate & <50% PMNs in lower airway secretions makes VAP unlikely

Klompas. JAMA. 2007;297(14)

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Ventilator-Associated Complication (VAC)

↑ Daily PEEP by 2.5 cm H_2O for ≥2 days

OR

↑ F_iO_2 by ≥15 for ≥2 days AFTER

Minimum of 2 days of stable or decreasing PEEP/F_iO_2

Klompas M, et al. PLoS One. 2011 Mar 22;6(3):e18062

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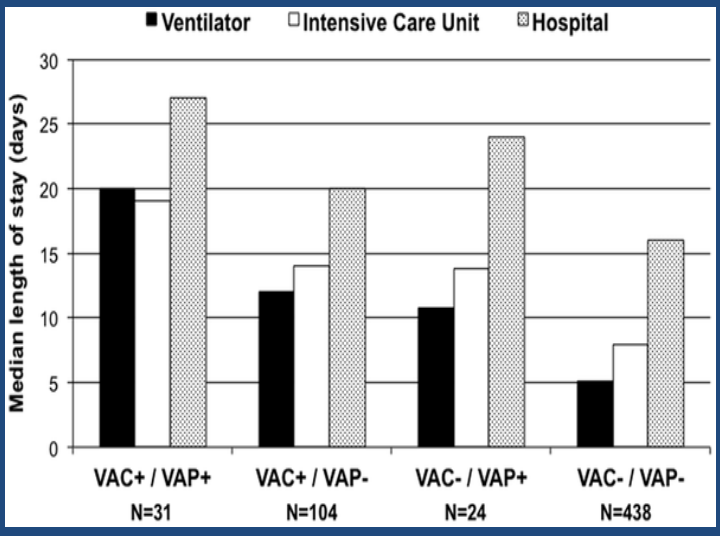
Of 597 study patients, 9.3% had VAP (8.8 per 1,000 ventilator days) and 23% had VAC (21.2 per 1,000 ventilator days)



Klompas M, et al. PLoS One. 2011 Mar 22;6(3):e18062

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Quantitative Cultures for VAP Diagnosis

- Pros
  - More specific diagnosis
  - Identify pathogens
  - Determine response to therapy
- Cons
  - More invasive
  - Clinical diagnosis may be as accurate

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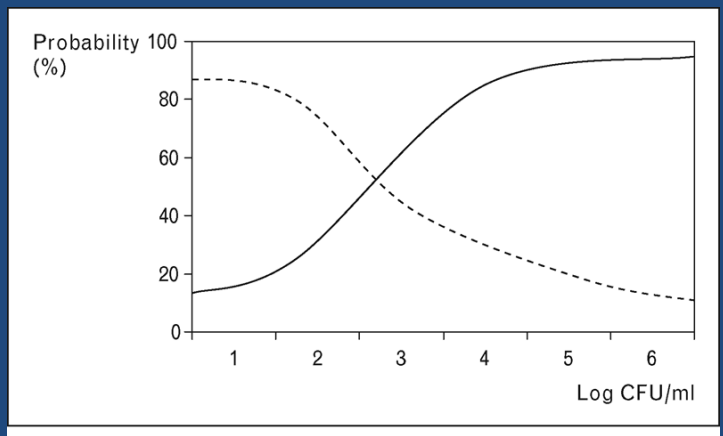
Probability of VAP across the range of colony counts in quantitative culture



CFU, colony-forming units. ——— Pneumonia; - - - - - - No pneumonia.
Adapted with permission from [6].

Lisboa T. Rello J. Curr Opin Infect Dis 2008;21:174-8.

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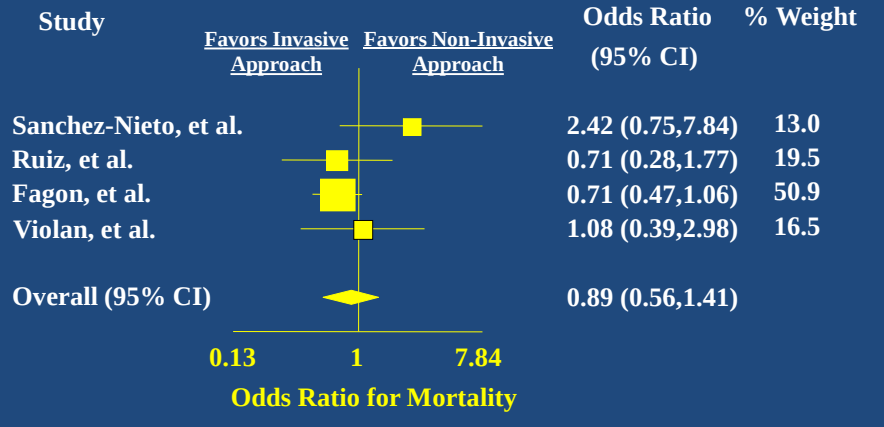
Meta-analysis of Invasive Strategies for the Diagnosis of VAP*



*Random effects model; Test of heterogeneity p=0.247, for Odds ratio p=0.620

Shorr A et al.Crit Care Med 2005;33:46.

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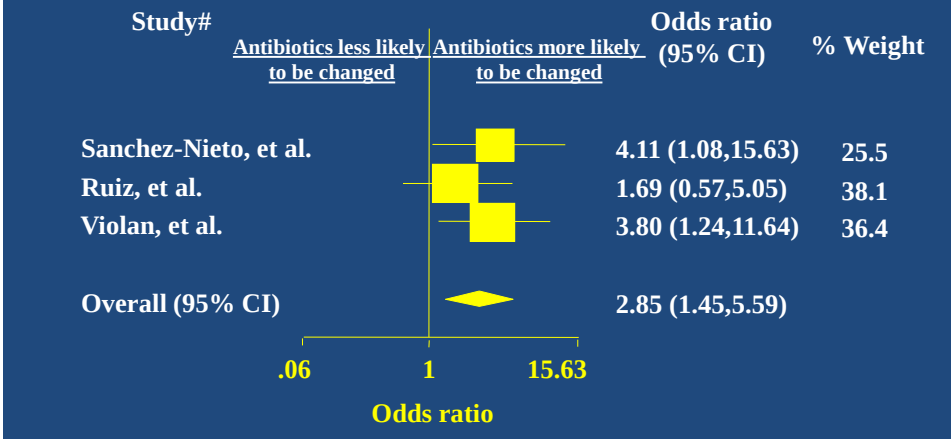
Meta-analysis of the Impact of Invasive Strategies on Antibiotic Management*



*Random effects model; Test of heterogeneity p=0.493, for Odds ratio p=0.002
#Fagon, et al. did not report how frequently invasive testing altered antibiotic management

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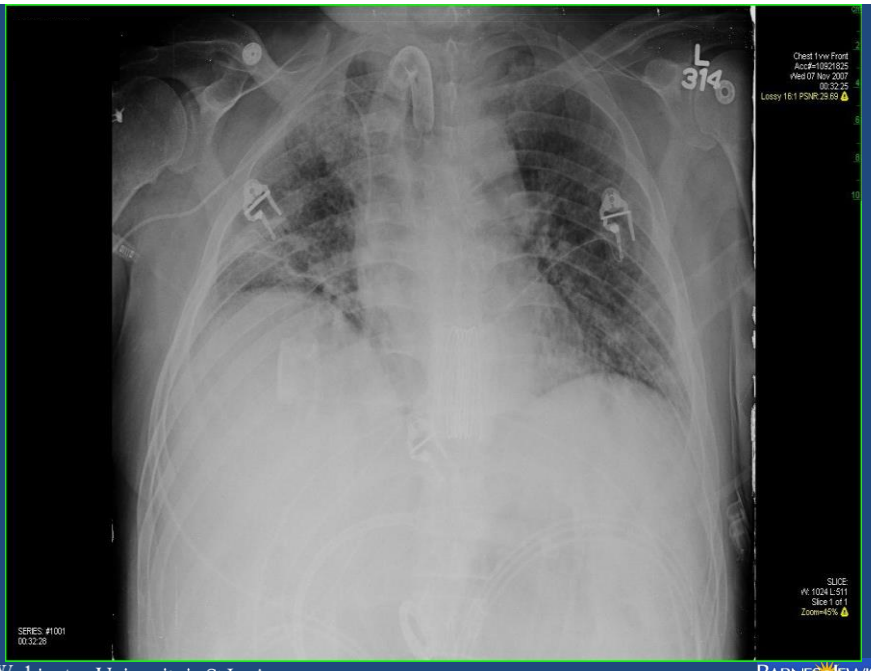

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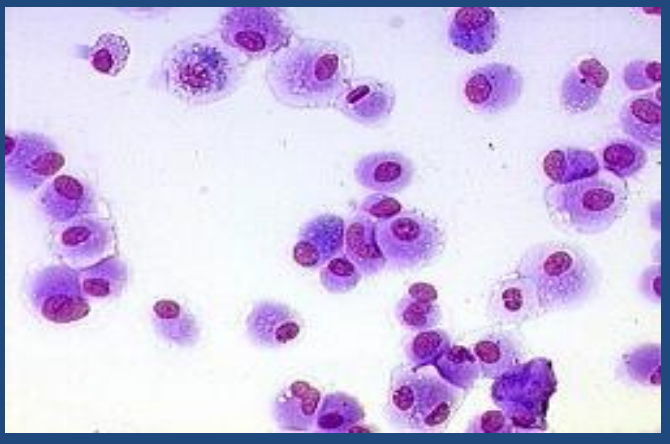
No VAP



BAL: 463 nucleated cells, 83% macrophages, no significant growth of bacteria.

No further antibiotics, recovered.

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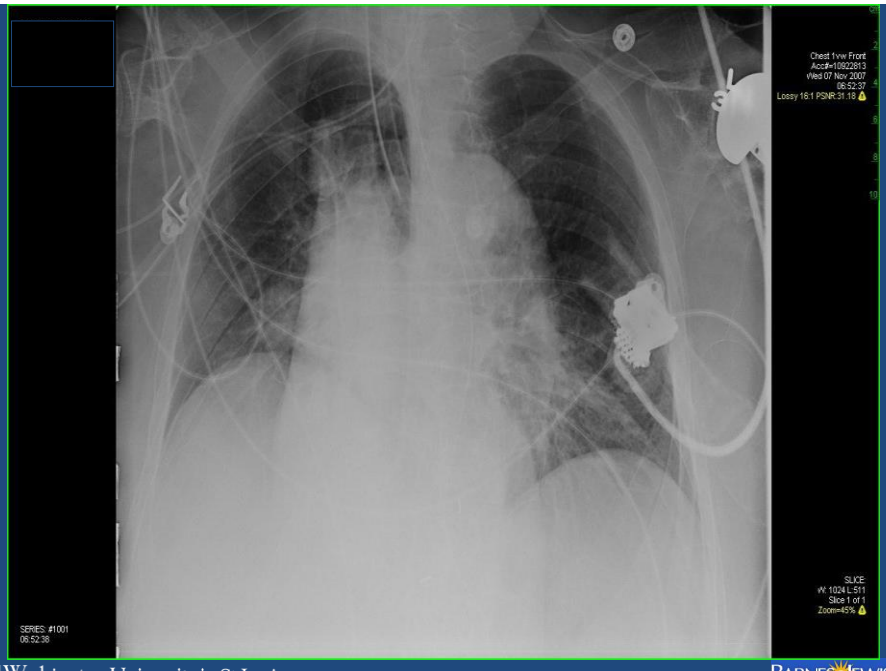

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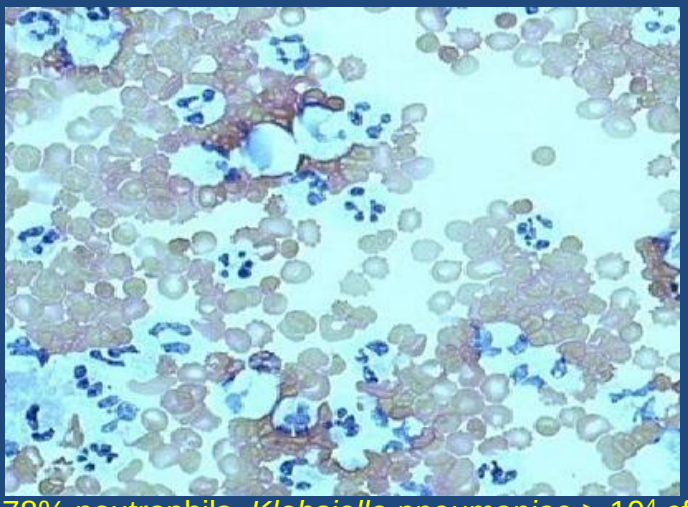
Yes there is VAP



BAL: 78% neutrophils, *Klebsiella pneumoniae* > 10^4 cfu/ml.
Treated with appropriate antibiotic regimen and recovered.

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Risk Factors in Ventilated Patients

Not easily modified

- Chronic lung disease
- Severity of illness
- Age > 60
- Head trauma / coma / ICP monitor
- Upper abdominal / thoracic surgery
- Neurosurgery
- Reintubation / self extubation
- ARDS

Bonten M et al. CID 2004;38:1141-9

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Modifiable Risk Factors in MV Patients

- Duration of ventilation
- Barbiturates
- H2 blockers or antacids
- Aspiration
- Vent circuit changes <48 hrs
- Supine head position
- Antibiotics
- NG and enteral nutrition
- Nasal intubation
- Intracuff pressure less than 20 cm H_2O

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Risk Factors for MDROs

Variable	Odds Ratio	95% Confidence Interval	p Value
Duration of MV before VAP episode ≥ 7 d (yes/no)	6.01	1.6-23.1	0.009
Prior antibiotic use (yes/no)	13.46	3.3-55.0	0.0003
Broad-spectrum antibiotics (yes/no)	4.12	1.2-14.2	0.025

Rello et al, Chest 1993;104:1230

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Risk Factors for Mortality

- Worsening respiratory failure
- Fatal underlying condition
- Shock
- Type of ICU
- Gram negative infection
  - *Pseudomonas and Acinetobacter*
- Inappropriate antibiotic therapy
  - Role of prior antibiotic exposure

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Methods Proposed to Reduce VAP Rates

- Noninvasive ventilation
- Avoid prolonged use of paralytic agents or IV sedation
- Extubate, remove NG tubes ASAP
- Elevate HOB ≥ 30°
- Maintain adequate cuff pressure
- Evaluate need & use of stress ulcer prophylaxis
- Evaluate need for transport out of ICU
- Avoid unnecessary reintubation
- Kinetic R_x, chest physiotherapy
- No circuit changes
- Careful drainage of tube condensate
- Single use products/devices
- Proper disinfection

Int Care Med 2002; 28: 822-823

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Pooled Results of Intervention Strategies for VAP

	# Studies	# Study	# Controls	RR (95% CI)
Sucralfate vs H_2 blockers	8	160/914	202/911	.21 (.05-.38)
Post pyloric vs gastric feeding	7	60/221	81/227	.24 (.01-.41)
Semi recumbent vs supine	2	15/151	19/156	.18 (.39-.76)
Subglottic aspiration	4	45/425	81/421	.45 (.23-.61)

CID 2004; 38: 1141-1149

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Bundled Interventions for VAP Prevention

- Process measures
  - Elevation of the head of the bed
  - Weaning protocols
  - Sedation vacation
  - Oral care
- IHI ventilator bundle
  - Elevation of the head of the bed
  - Daily “sedation vacations" and assessment of readiness to extubate
  - Peptic ulcer disease prophylaxis
  - Deep venous thrombosis prophylaxis

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Elevation of the Head of the Bed

- Pathophysiology of VAP: abnormal pharyngeal colonization, in part related to gastric reflux, followed by aspiration
  - Study with radioactively-labeled gastric contents has demonstrated that reflux and aspiration can be reduced by elevation of the head of the bed to > 30º
  - Supine head position associated with a 3 fold risk of pneumonia

Torres A et al. Ann Intern Med. 1992;116:540
Kollef MH et al. JAMA. 1993;270:1965.

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Elevation of the Head of the Bed

- Randomized trial from 1999-2000 in 4 ICUs in 3 hospitals
- Target bed positions: 10º vs. 45º
- VAP definitions
  - Clinically suspected: CDC pneumonia 1 criteria plus positive tracheal aspirate culture
  - Microbiologically confirmed: above PLUS BAL with ≥ 10^4 cfu/mL

Variable	Supine (n = 109)	Semi-recumbant (n = 112)
Average elevation day 1 & 7	9.8º & 16.1º	28.1º & 22.6º
VAP clinically suspected	18.3%	14.3%
VAP microbiologically confirmed	11.6%	7.3%

Van Nieuwenhoven CA et al. Crit Care Med. 2006;34:396-402.

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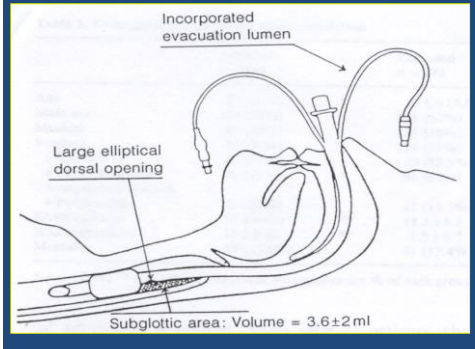
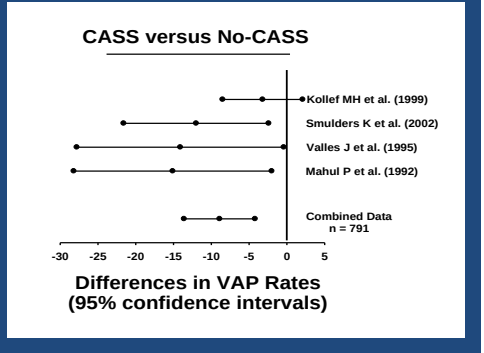
Patient Position & VAP; Meta-Analysis

- 3 RCT Semi-recumbent and 4 RCT prone position
- VAP Odds semi-recumbent (OR=0.47, 95% CI 0.27-0.82; 337 patients)
- Prone outcomes trended better (OR=0.80, 95% CI 0.60-1.08; 1018 patients)
- No difference in mortality, small number of studies, heterogeneity

Alexiou et al, J Crit Care 2009; 24: 515-22.

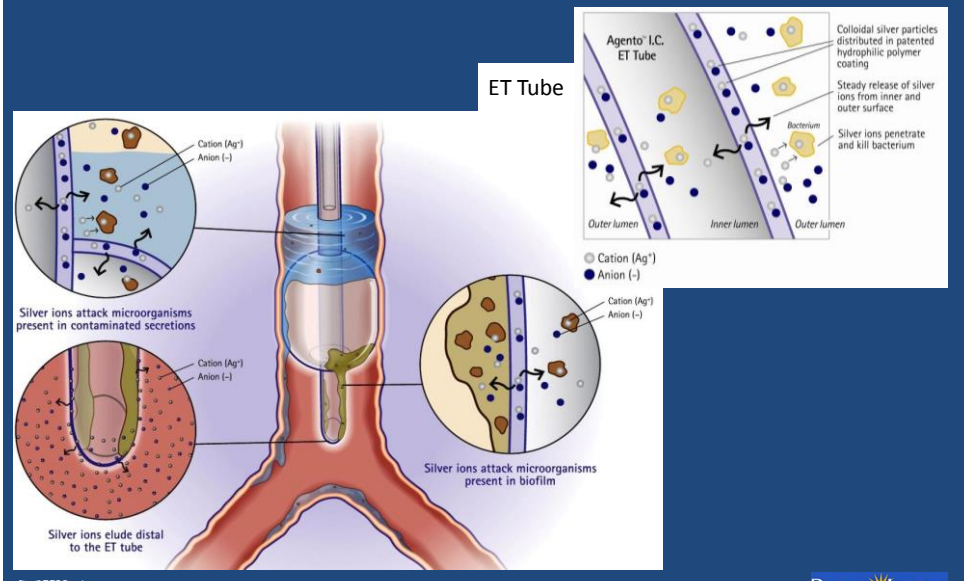
Continuous Subglottic Secretion Suctioning





Mahul et al. Int Care Med 1992;18:20.

Mechanism of Action: Silver-Coated ETT



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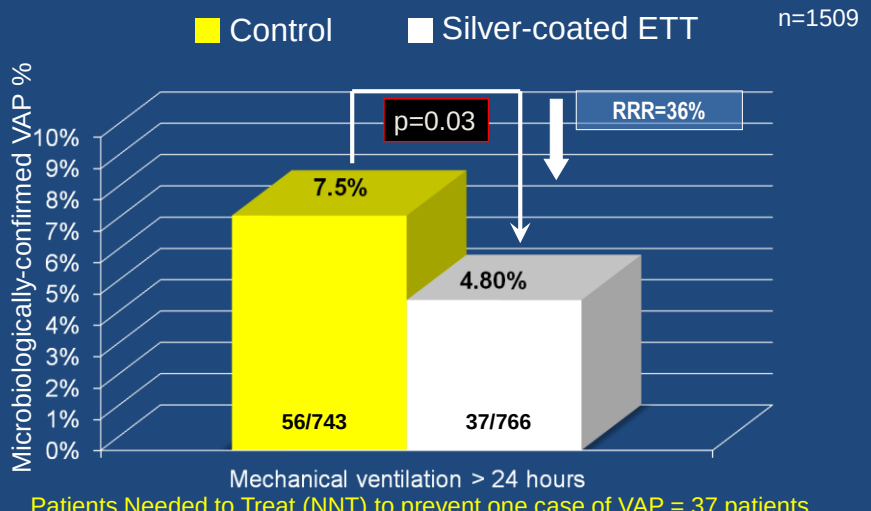
The NASCENT Study Results

Microbiologically-confirmed VAP



Patients Needed to Treat (NNT) to prevent one case of VAP = 37 patients

Kollef M, et al. JAMA. 2008.

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Ag^+ Coated ET Tube and ↓ Mortality in Patients with VAP

- NASCENT, prospective RCT; 54 Centers in NA, 2002 – 2006
- Retrospective cohort analysis of VAP patients for mortality outcome
-

MV Analysis	OR	95% CI	p value
Treatment Group	.28	.09 - .89	.03
Apache II	2.67	.96 – 7.41	.06
Inapp AB	3.14	.92 – 10.72	.07

Afessa et al, Chest 2010; 137(5): 1015-21.

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Weaning Protocols

- Randomized trial of 385 patients receiving MV and ready to wean in a MICU and SICU between 6/97 and 5/98
- Arms: Physicians' orders required for all vent changes vs. ventilator management protocol using spontaneous breathing trials by RTs

Outcome	Physician directed	Ventilator management protocol	p Value
Duration of mechanical ventilation	124 hrs	68 hrs	< 0.001
VAP	20	11	0.10*

*Surgery ICU 12/5, p = 0.06, but duration of MV not significant

Marelich GP et al. Chest. 2000;118:459.

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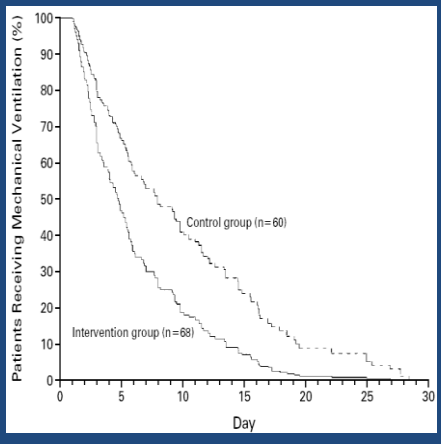
Sedation Vacation

- RCT of 128 adult patients receiving MV and continuous infusion of sedatives in a MICU
- Arms: Daily interruption of sedation until patient awake vs. interruption only by clinicians
- Outcomes
  - Median duration of MV: 4.9 vs. 7.3 days (p = 0.004)
  - Median ICU LOS: 6.4 vs. 9.9 days (p = 0.02)
  - Diagnostics for mental status: 9% vs. 27% (p = 0.02)
  - VAP rates not assessed

Duration of MV



Kress JP et al. N Engl J Med. 2000;342:1471

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Selective Decontamination & Oral Care

- Theory: ↓ microbial burden in upper airway
- Two approaches
  - Selective decontamination of the digestive track with antibiotics via NG tube
    - More common in Europe
    - Controversial due to concerns about emergence of resistant organisms
  - Oral decontamination
    - Topical oral antibiotics or antiseptics
    - Two recent meta-analysis suggest antiseptic oral decontamination can decrease VAP
      - Chlorhexidine (CHG) alone
      - All antiseptics (CHG, povidone iodine)

Chan EY et al. BMJ. 2007;334:889; Chlebicki MP et al. Crit Care Med. 2007;35:595.

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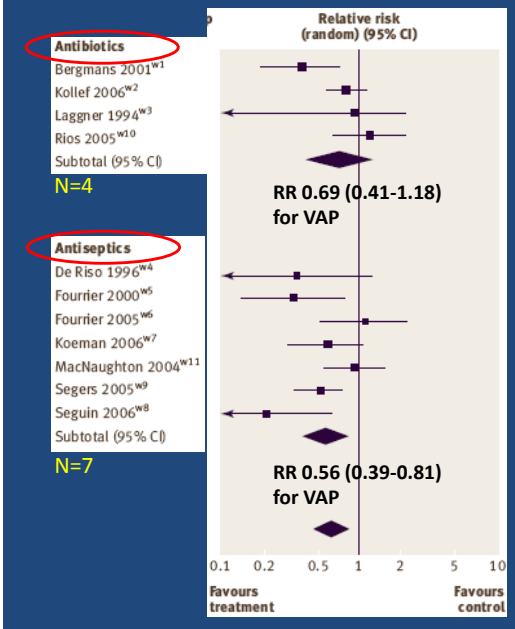

- Decrease in VAP with antiseptic but not antibiotic oral care
- No impact on mortality or ICU LOS
- Greatest impact in patients post cardiovascular surgery

Chan EY et al. BMJ. 2007;334:889.

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Prevention of VAP

Intervention	Reference	# Pts	RRR of VAP % (95 CI)	RRR Mortality % (95 CI)
Topical Antibiotics (SDD & SOD)	Krueger	546	80 (41–93)	24 (-9 to 47)
	De Jonge	934	NA	35 (13–57)
	De Smet	5939	NA	13 (3–28) 11 (1–26) @day 14
GHG oropharynx	Fourier	228	-8 (-127 to 48)	-29 (-106 to 19)
	Koeman		42 (-9 to 69)	-29 (-81 to 9)
	Segers	991	NA	-29 (-148 to 90)

Weinstein and Bonten, CID 2011; 52(1): 115-21.

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Probiotics to Prevent VAP

PI	# Pts	RRR of VAP % (95 CI)	RRR Mortality % (95 CI)	Site
Knight	259	30 (-41 to 65)	21 (-22 to 49)	New Zealand
Klarin	44	70 (-170 to 97)	-14 (-269 to 65)	Sweden
Morrow	138	47 (14 – 67)	18 (-63 to 58)	US

Weinstein and Bonten, CID 2011; 52(1): 115-21.

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Meta-Analysis of Probiotics and VAP

- 5 RCT included
- 689 pts, OR 0.61 (95% CI 0.41 – 0.91) VAP fixed effects model
- Random effects model OR 0.55 (0.31 – 0.98)
- Length of ICU stay fixed effects -.99 days (-1.37 - -0.61)
- Colonization with *Pseudomonas* OR=0.35 (0.13 – 0.93 CI)
- No difference ICU mortality, duration of MV or diarrhea

Siempos, Crit Care Med. 2010; 38: 954-62.

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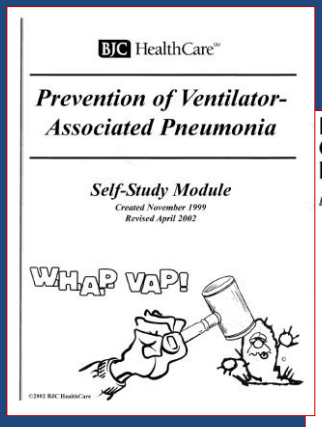
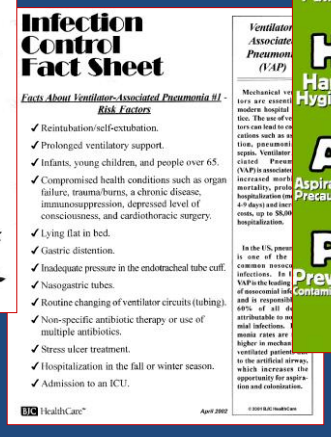
VAP Components





Zack J, et al. Crit Care Med. 2002.

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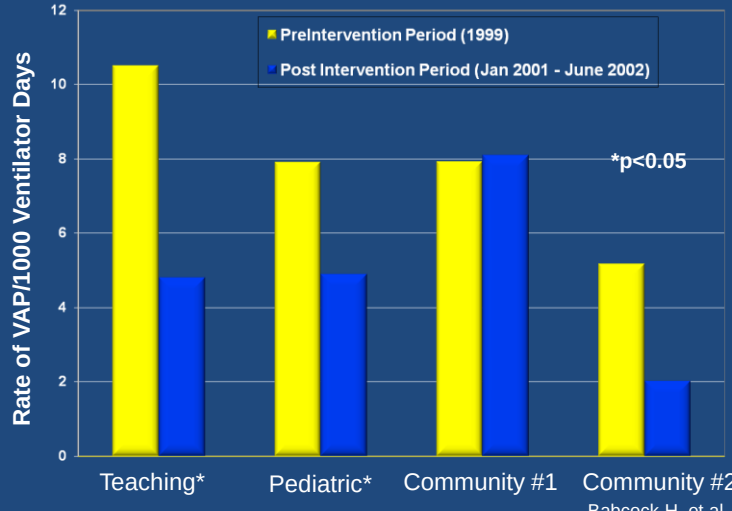
VAP Rates – Pre-intervention and Post-intervention by Hospital



Babcock H, et al. Chest. 2004.

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Impact of The Educational Program on Outcomes in a Thai MICU

	Phase 1			Phase 2			Phase 3		
Outcomes	MICU (n=422)	SICU (n=442)	CCU (n=428)	MICU (n=482)	SICU (n=460)	CCU (n=420)	MICU (n=962)	SICU (n=903)	CCU (n=855)
VAP rate	21 ±4.8	5.4±4.2	4.4±2.9	8.5±4.2	5.6±3.1	4.8±3.2	4.2±3.1	5.5±3.7	4.6±2.5
Total duration of hospital stay, days	14±6.4	5.2±2.4	6.1±3.3	5.5±3.6[a]	5.8±2.3	6.2±3.5	5.1±3.5[a]	5.6±2.6	6.5±3.4
% Crude mortality,	65(14)	35(8)	39(9)	63(13)	46(10)	34(8)	143(15)	81(9)	77(9)

Apisarnthanarak A, et al. CID. 2007.

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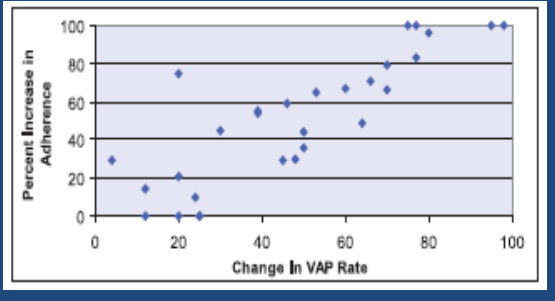
Use of IHI Ventilator Bundle Reduces VAP

- IHI bundle implemented in 61 hospitals
- 84% used the CDC definition of VAP
- 35 units measured VAP data and adherence to the bundle
- In the 21 units with ≥ 95% compliance with bundle, VAP rates decreased from 6.6 to 2.7 per 1000 ventilator days ($p < .001$)



Resar R et al. J Qual Pt Safety. 2005;31:243

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Outcomes

Author	Year	Country	Bundle Adherence	VAP Incidence (per 1000 MV Days)
Resar	2005	US and Canada	21 of 35 participating centers achieved 95% adherence	Baseline: 6.6 After: 2.7 (1.8 - 5.9)
Berriel-Cass	2006	US	Not reported	Baseline: 8.2 After: 3.3
Youngquist	2007	US	100% compliance achieved by 1/04 (~ 6 months into intervention phase)	Baseline: 6.01 and 2.66 After: 2.7 and 0.0
Unahalekhaka	2007	Thailand	Not reported	Baseline: 13.3 After: 8.3

Zilberberg MD, Shorr AF, Kollef MH. *Critical Care Medicine.* 2009.

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Adherence to VAP Bundle and VAP Rates in a SICU/TICU

- Boston U, 2 ICUs, IHI Ventilator Bundle, 2006 – 2009
- Prospective Data Collection, Retrospective Analysis
- Bundle Compliance ↑ 45 – 90% & 60 – 80%
- Dashboard Bundle Compliance on Screen
- VAP rates ↓ 10/1000 vent days to 4/1000 vent days. P=.004

Bird, et al, Arch Surg 2010; 145(5): 465-70.

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Translating Research into Practice

- Vanderbilt Univ Hospital TICU Electronic Dashboard, 2006 – 2008
- Process measures to ↓ VAP, CLABSI, UTI
- Color-coded online compliance monitoring
- UTI ↓ 76.3%, BSI ↓ 74%, VAP ↓ 24.9%
- Change in UTI and BSI significant $p<0.05$

Miller, J Trauma 2010; 68: 23-31.

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Realistic/Optimal VAP Prevention Program

20-bed MICU in Paris: Intervention consisted of:

1) Creation of multidisciplinary task force
2) Educational sessions
3) Direct observations and performance
4) Feedback
5) Technical improvements and reminders

It focused on 8 targeted measures selected based on:

1) Well-recognized published guidelines
2) Easily and precisely defined acts
3) Directly concerned HCW bedside behavior

Compliance assessment consisted of five 4-week periods

- Before the intervention and 1, 6, 12 and 24 months thereafter

Bouadma L, et al. Crit Care Med. 2010 Jan 9.

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VAP RATE / 1000 Ventilator Days

Bouadma L, et al. Crit Care Med. 2010 Jan 9.

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Non-Pharmacological Measures

Non-Pharmacological measures	ETF	CDC	CCCS	ATS/ IDSA	Recommendations
Infection control	✓.	✓.	--	✓.	✓Surveillance
Handwashing	✓.	✓.	--	✓.	✓Clorhexidine
Early weaning	--	--	--	✓.	✓RT guidelines
NIV	✓.	✓.	--	✓.	✓COPD/Low O_2
Staffing	--	--	--	✓.	✓Staff (1:1)
ETT/OGT	?	✓.	✓.	✓.	✓Subglottic suction
Cuff pressure	✓.	--	--	✓.	✓>20 cm H_2O
Avoid circuit Δ's	✓.	✓.	✓.	✓.	✓Only contaminated
Semirecumbency	✓.	✓.	✓.	✓.	✓.30-45 degrees
Kinetic beds	--	--	✓.	--	✓.Surgery/Neuro

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Pharmacological Measures

Pharmacological measures	ETF	CDC	CCCS	ATS/ IDSA	Recommendations
Oral care	--	✓	--	?	✓ Clorhexidine
SDD	?	?	?	✗	Controversial
Biofilm formation	--	--	--	--	Pending
Prophylactic Abx	?	?	--	✗	✗ Subgroups
Stress ulcer prophylaxis	?	?	✗	✓	✓ MV>48h -Coagulop
Transfusion restriction	--	--	--	✓	✓ CAD – Hb <7g/dL
Glycemic control	--	--	--	✓	✓ Post-Surg/<150
Sedation	--	--	--	✓	✓ Sedation break
Adequate Abx	--	--	--	✓	✓ Short course
Nutrition	--	--	--	✓	✓ Enteral/Post-pyloric

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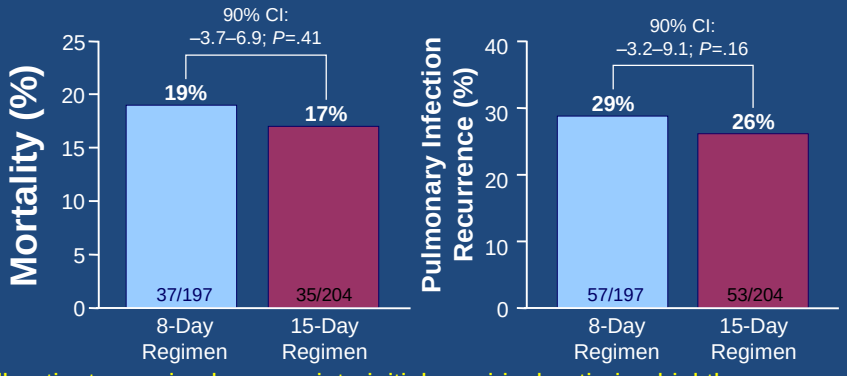
Effectiveness of a Shorter Duration of Antibiotic Therapy Among Patients With VAP

Prospective, multicenter, randomized, double-blind trial (France)



- All patients received appropriate initial empirical antimicrobial therapy

CI=confidence interval.

Chastre J, et al. JAMA. 2003;290(19):2588-2598.

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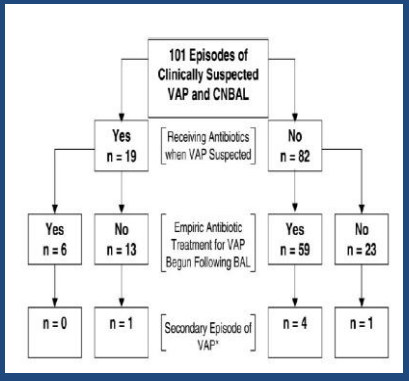
Can Antibiotics Be Safely Stopped if BAL Cultures are Negative?

- Prospective observational study of 101 patients with clinical suspicion of VAP but culture negative BAL
  - Consider stopping therapy in CNBAL, if clinically appropriate, after initial broad spectrum therapy (de-escalation)
- 64.4% given empiric rx after BAL (CPIS 6.5 for these vs. 5.8 if no rx, p<0.001)
  - 66.1% of these with specific non-infection dx
  - Hospital mortality similar if got or did not get initial rx (33.8% vs. 36.1%)
- All had antibiotics D/C (clinical decision) within 3 days of starting
- 6 patients got a second epidode of pneumonia (4-9 days after initial BAL
- CNBAL, even if on antibiotics when sampled, may be an indication to stop therapy if clinically stable, esp if initial CPIS is not high



Kollef et al. Chest 2005; 128:2706

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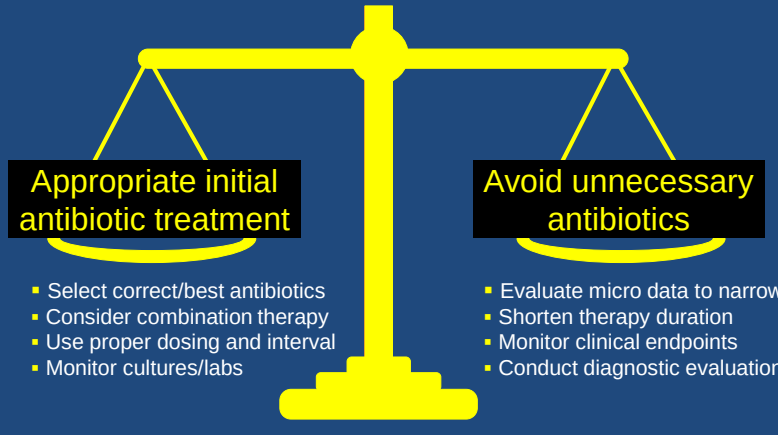
De-Escalation—A Balancing Act



- Select correct/best antibiotics
- Consider combination therapy
- Use proper dosing and interval
- Monitor cultures/labs

- Evaluate micro data to narrow scope
- Shorten therapy duration
- Monitor clinical endpoints
- Conduct diagnostic evaluation

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Summary and Conclusions

- VAP is a serious healthcare associated infection with significant morbidity and mortality
- Risk factors are associated with the host and our treatments for critically ill patients.
- Duration of intubation is the most significant risk factor.
- Diagnosis of VAP is complex but important for surveillance and clinical purposes

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Summary and Conclusions

- VAP bundles contain measures that are not specifically related to VAP prevention
- Quantitative cultures can be helpful for diagnosis
- There is good evidence for shorter courses of antibiotic therapy than have traditionally been given for VAP

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Thank You

- Questions?
- Contact Information
- Victoria Fraser (314) 362-8061
- vfraser@dom.wustl.edu

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HICPAC Guideline for Preventing Healthcare-Associated Pneumonia: 2003

- Do not change routinely on the basis of duration of use the breathing circuits, but only when visibly soiled or mechanically malfunctioning 1A
- Drain and discard condensate taking precautions not to allow condensate to drain towards the patient 1B
- Hand hygiene 1A
- Wear gloves for handling respiratory secretions 1B
- If feasible use an endotracheal tube with dorsal lumen above cuff II
- Unless contraindicated perform orotracheal rather than nasotracheal intubation 1B
- When feasible use non-invasive ventilation II

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HICPAC Guideline for Preventing Healthcare-Associated Pneumonia 2003

- In absence of medical contraindication, elevate head of bed 30-45º II
- Develop and implement comprehensive oral hygiene program II
- CHG oral rinse during perioperative period in adults who undergo cardiac surgery II
- CHG rinse for all patients unresolved issue
- Oral decontamination with topical antimicrobial agents unresolved issue
- Preferential use of sulcrafate, H_2-antagonists, or antacids for stress-bleeding prophylaxis in mechanically ventilated patients unresolved issue

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HICPAC Guideline for Preventing Healthcare-Associated Pneumonia 2003

- Pneumococcal vaccine to patients at high risk 1A
- Routine vaccination of HCWs with acellular pertussis vaccine-unresolved issue but now ACIP recommendation
- Vaccinate high risk patients and HCWs for influenza vaccine 1A

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Compendium: Detection and Prevention of VAP (1)

ICHE 2008; 29:S31-S40

- Basic Practices

1. Educate HCW who care for ventilated patients about VAP including local epidemiology, risk factors, and patient outcomes (A-II)
2. Educate clinicians about non-invasive vent strategies (B-III)
3. Ensure all patients (except those with contraindications) are maintained in semi-recumbent position 30-45º (B-II) recent studies report semi-recumbent positioning not maintained and may not be associated with reduced VAP
4. Perform regular antiseptic oral care in accordance with product guidelines (A-I) Optimal frequency unresolved
5. Conduct surveillance for VAP and associated process measures to include identification of patients with VAP and calculation of VAP rates (A-II)
   - -adhere to hand hygiene guidelines
   - -perform readiness to wean and use weaning protocol
   - -daily sedation vacation

N Engl J Med 1998; 339:429; N Engl J Med 2000; 342:1471; N Engl J Med 1996; 335:1864; Crit Care Med 2006; 34:396

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Compendium VAP (2)

ICHE 2008; 29:S31-S40

- Implement policies and practices for disinfection, sterilization, and maintenance of respiratory equipment that are aligned with evidenced-based standards (HICPAC/CDC) A-II
- Special Approaches (lack of effective control despite implementation of basic practices)

1. Use an endotracheal tube with in-line and subglottic suctioning (B-II)
2. Ensure that all ICU beds used for ventilated patients have a built-in tool to monitor angle of incline (B-III)
3. Conduct active surveillance for VAP in units that care for ventilated patients based on risk assessment (A-II)

Ann Intern Med 1995; 122:179

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Compendium VAP Prevention (3)

ICHE 2008; 29:S31-S40

- Approaches that should not be considered
  1. Routine administration of IVIG, enteral glutamine, white cell stimulating factors, or chest physiotherapy
  2. Rotational therapy with oscillating beds
  3. Prophylactic aerosolized or systemic antimicrobials
- Unresolved issues
  1. Avoidance of H_2receptor antagonist or PPI in patients who are not at high-risk for GI bleeding (HICPAC identified the preferential use of sucralfate or H_2 blocking agents as an unresolved issue *MMWR 2004; 53(RR-3):1-36)*
  2. Selective GI decontamination for all vent patients
  3. Use of antiseptic-impregnated endotracheal tubes
  4. Intensive glycemic control

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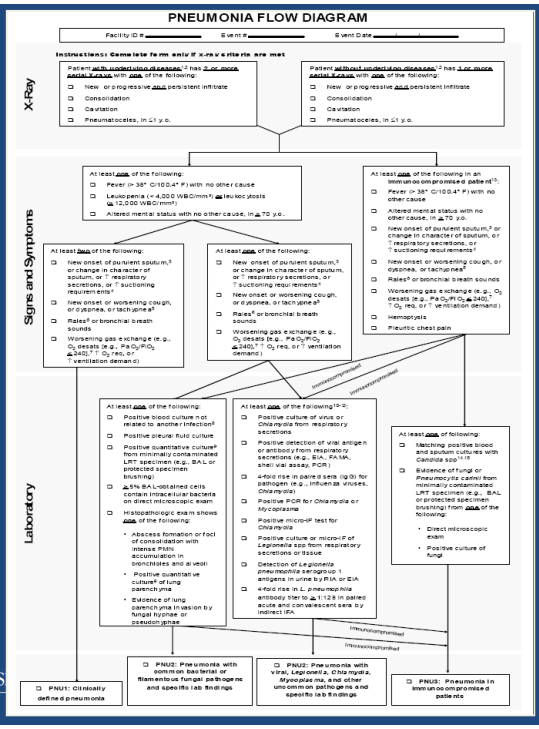

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